A

Photographic Record

of the

Scientific Observation Hole (SOH) Program

April 20, 1992

May 27, 1992

Scientific Observation Hole (SOH) Program

PHOTO PRESENTATION

Photos by:
Harry J Olson, HNEI, University of Hawaii at Manoa
John E. Deymonaz, Consultant, SOH Drilling Manager
Andrea Gill Beck, Hawaii Energy Extension Service

Photo No.	Film No.	Date	Description
1	398255-18	28 Nov 89	Clearing (grading and grubbing) SOH-4 site with surveyor directing bulldozer.
2	136987-37	27 Apr 90	Puu Oo in background emitting vog during Kona (SE) wind conditions. True Drilling Company drill is middle ground. Tonto U-5000 drill rig is in foreground at SOH-4 site. According to the US Geological Survey at the Hawaii Volcano Observatory, Kilauea Volcano, which includes Puu Oo emits approximately 1,678,300 kg (3,700,000 lbs) per day of SO_2 gas of which about 27,200 to 54,400 kg (60,000 - 120,000 lbs) is H_2S. When not erupting Kilauea emits about 181,400 to 317,500 kg (400,000 - 700,000 lbs) per day of SO_2 gas of which 1,800 to 5,400 kg (4,000 - 12,000 lbs) is H_2S.
3	136987-31 (slide)	27 Apr 90	Aerial view of SOH-4 site along True drill access road. Site dimensions are 125 x 100 feet.
4	394805-17	16 May 90	Tonto U-5000 drill rig at SOH-4 site. Blue tank in right foreground contains drilling water. Note: Hospital mufflers quiet drill engine which is completely enclosed with sound buffer paneling.
5	789947-01 (slide)	3 Feb 90	Cementing surface casing at SOH-4 site.

6	789947-14 (slide)	3 Feb 90	Drillers pouring cement in SOH-4 during surface casing cementing operation.
7	JED Photo (3)	Jan 90	Halliburton crew cementing a deep string of casing at SOH-4 site.
8	416676-02	22 Jan 90	Mixing drilling mud at SOH-4 site. Note: John E. Deymonaz, SOH drilling manager in blue coat; Hawaiian drill helpers in yellow rain pants; supplies and materials stacked around periphery of drill site; Noise monitor at left center next to pallets.
9	136797-03	11 May 90	Hawaiian drilling helpers perforating drill rods to be inserted into SOH-4 to keep the hole open for monitoring.
10	394805-06	10 Apr 90	Elizabeth Novak, Senior, University of Hawaii at Hilo logs and stores core in a container at SOH-4 site. Ms. Novak is the first person to graduate with a geology major from the University of Hawaii at Hilo.
11	394805-18	16 May 90	Tonto U-5000 drill rig at SOH-4 site.
12	411633-16 (slide)	6 Feb 90	Sound monitoring instrument at SOH-4 site. Sound at the drill site and at nearby residences was monitored and recorded 24 hours per day. Permitted sound levels at the nearby residences were 45 dBA at night (7 p.m. to 7 a.m.) and 55 dBA during daytime hours. Sound levels at the SOH-4 drill site were very quiet (about the level of a normal conversation) and averaged between 60-65 dBA.
13	491776-8A	12 Dec 90	SOH-4 wellhead. Gauge indicates "0" wellhead pressure. Potted ohia trees lining the fence are for site restoration.
14	JED Photo (7)	16 Nov 89	Reverend William Kaina, of the Kaiwaiahao Church in Honolulu, blessing the SOH-1 site.

15	A.G. Beck (slide)	8 Nov 90	Aerial view of HGP-A - Puna Research Center in the foreground, KS-3 well of Puna Geothermal Venture (PGV) in the middleground, and the SOH-1 site in the background.
16	451595-11	20 Jul 90	Aerial view of SOH-1 site. Extreme care was taken in selecting the drill sites so that they would have minimum environmental impact and would be as far as possible from local residences. The SOH-1 site is more than 1,400 feet from the nearest residences seen along the Pohoiki road.
17	329322-10	12 Dec 90	Tonto U-5000 drill rig at SOH-1. Rig modifications to reduce noise levels continued throughout the SOH program. Notes: Stacks above the drill rig engine compartment permit ventilation cooling, and direct engine sounds upwards.
18	729195-07	14 Aug 90	Tonto U-5000 drill rig at SOH-1. Note: Sound buffer panels enclose the rig substructure and the sheave wheel at the top of the drill mast. Containers with supplies, the meteorological monitoring instruments, the remote BOP controls, and diesel fuel are located adjacent to the substructure to further buffer ground level drilling sounds.
19	729195-12	14 Aug 90	Blow-Out-Preventor (BOP) at SOH-1 can be activated from the rig floor control panel and at a remote off drill rig site to prevent fluids under pressure from escaping to the surface.

20	825770-32	10 Oct 90	Mud pit at SOH-1. Drilling mud with drill cuttings enters the mud pit through the hose extending to the white barrel. Coarse cuttings drop out in the baffle at the barrel and the fines drop out at the near end of the mud pit. Drill mud is recycled from the far end of the mud pit, down the drill hole to cool the bit, lubricate the drill rods, prevent drill fluids from escaping into narrow fractures, and bring the drill cuttings to the surface.
21	825770-36	10 Oct 90	Drilling mud outlet at SOH-1 site. Note: Horn activated by sensor at mud outlet will sound the alarm if H_2S contained in the mud or in pockets reaches a level of 5 ppm. The only time the alarm sounded during the entire drilling program was during daily tests.
22	825770-26	10 Oct 90	Some of the worn out, diamond core drill bits consumed in drilling through the cool, fractured, submarine basalt dikes and flows at SOH-1.
23	825770-21	10 Oct 90	Highly fractured submarine basalt from SOH-1 in core trough prior to storing in core box.
24	491776-7A	12 Dec 90	Emptying core from core barrel at SOH-1. Note: Core stored in core box is from interval above core in trough.
25	43352-23	6 Dec 90	Group from the Research Corporation of the University of Hawaii inspect drilling operations at the SOH-1 site. Note: Many groups from industry, government, academia, as well as local and school groups visited the SOH sites to observe drilling operations.
26	JED Photo (4)	Jan 91	Pruett crew logging SOH-1.

27	45278-03	3 Jul 91	Rene Evans, SOH core curator, and Elizabeth Novak, SOH core logger, determine SOH-1 location and elevation with Magellan Global Positioning System (GPS) instrument. Evans and Novak were awarded a plaque for the most informative poster in October at the Geothermal Resources Council (GRC) 1991 annual meeting in Reno, Nevada.
28	43352-34	26 Feb 89	View of SOH-2 site area taken during aerial reconnaissance to check SOH sites for access and potential impact prior to permitting and clearing of site. SOH-2 is about 1/4 inch above small field shack in center. Perry residence is in lower left corner about 1/3 mile from site. Hedtke residence is in upper left corner approximately 0.45 miles from site.
29	545819-04	30 Jan 91	Moving Tonto U-5000 drill rig on SOH-2 site.
30	20125-07	15 Feb 91	Filling SOH-2 mud pit with water. Note: Black plastic liner in mud pit seals the pit and prevents drilling mud from spreading beyond the pit area.
31	20125-13	15 Feb 91	Drilling operations at SOH-2. White container behind drill rig serves as change house and contains the meterological and sound monitoring instruments and recorders.
32	445031-16	8 Apr 91	Mixing drilling mud at SOH-2.
33	JED Photo (16)	Apr 91	Tonto U-5000 drill rig at SOH-2 site. Note: Containers are aligned to block ground level drilling sounds in the direction of the nearest residence - about 1/3 mile to the north of the drill site. The plowed ground in the foreground was planted with papaya during the time SOH-2 was being drilled.

34	33062-15A	6 Jun 91	USGS high temperature logging truck logging SOH-2.
35	459870-06 (slide)	14 Aug 90	SOH-4 NQ core with coral sand intermixed with basalt rubble and flows at a depth from the surface of 5,812 feet.
36	136989-08 (slide)	30 Apr 90	Core logging table in the Puna Research Center.
37	59870-15 (slide)	14 Aug 90	SOH core storage container. Hawaii Natural Energy Institute (HNEI) trailer mounted wire (slick) line hoist to left of container.
38	JED Photo (15)	15 Jan 91	Tonto U-5000 drill rig moving on HGP-A well for clean-out and installation of Downhole Coaxial Heat Exchanger (DCHE) pipe for PICHTR research project.
39	21301-0X (slide)	Feb 91	Puna Geothermal Venture (PGV) site. Note: Power plant construction is off picture to the right. KS-3 drill site is in center middle ground and the HGP-A - PRC site is in the left middle ground. Volcanic emissions obscures Puu Oo in the background.
40	95816-19	24 Oct 92	PGV 30 megawatt (gross) 25 megawatt (net) geothermal hybrid (high back pressure single flash-binary cycle) power plant. True drill rig is at KS-11 site to right, and the HGP-A - PRC facility is in the center middle ground.

cSOH/PHOTO3
31 May 1992


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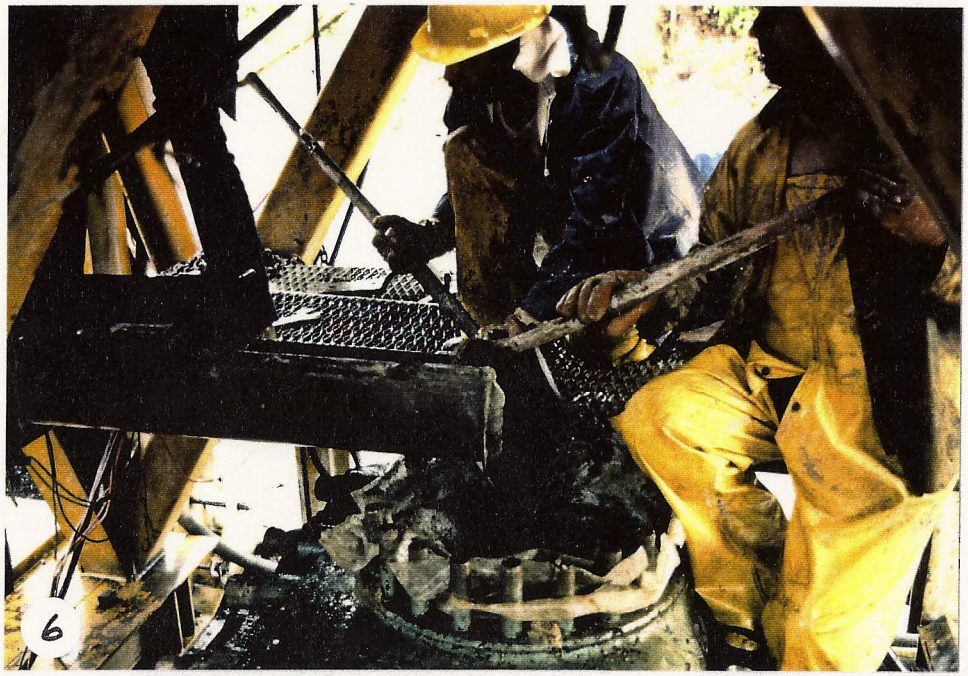
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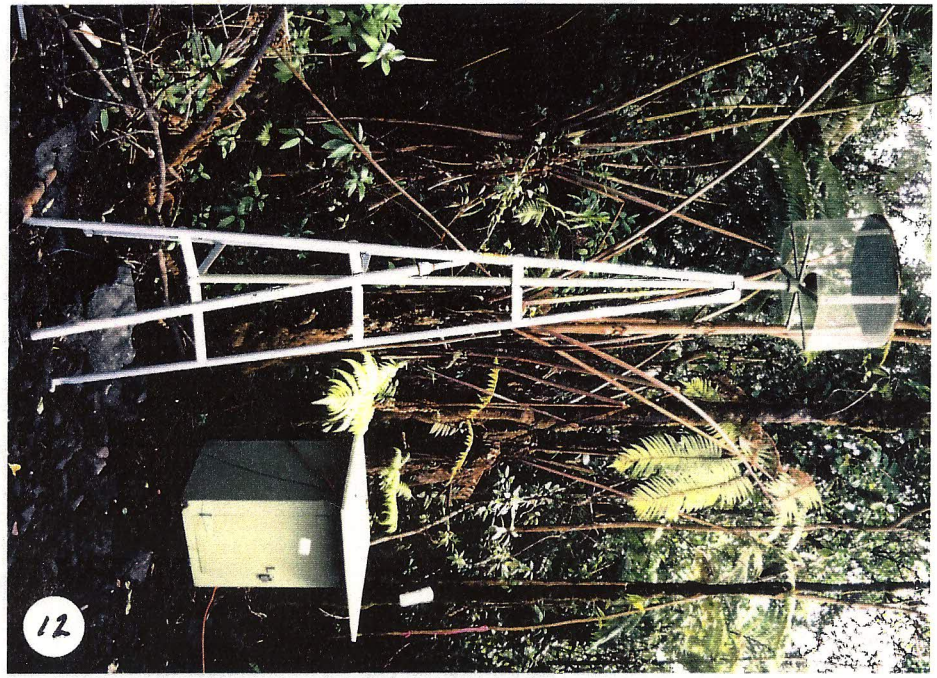
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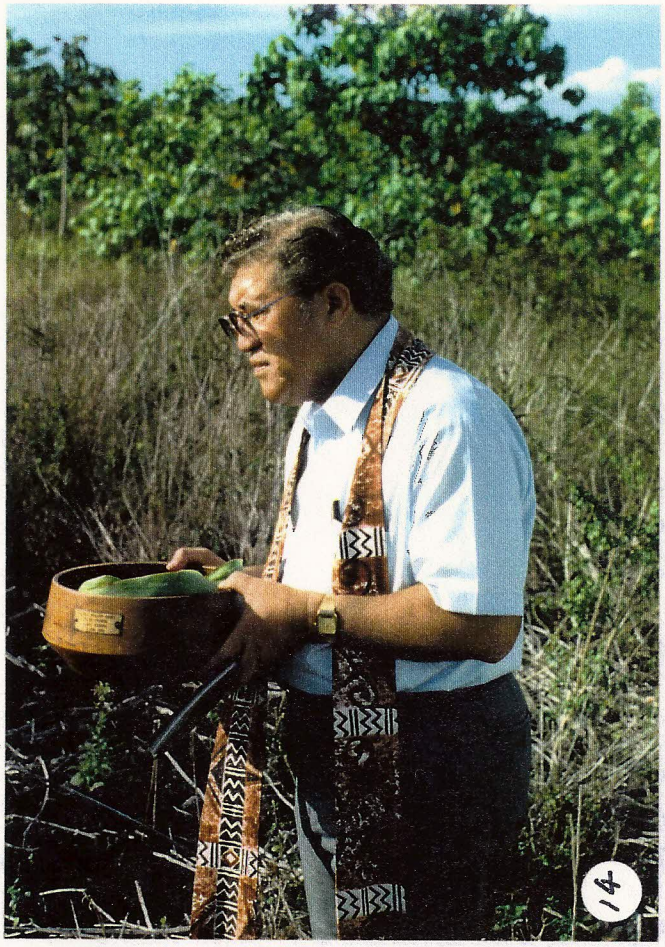
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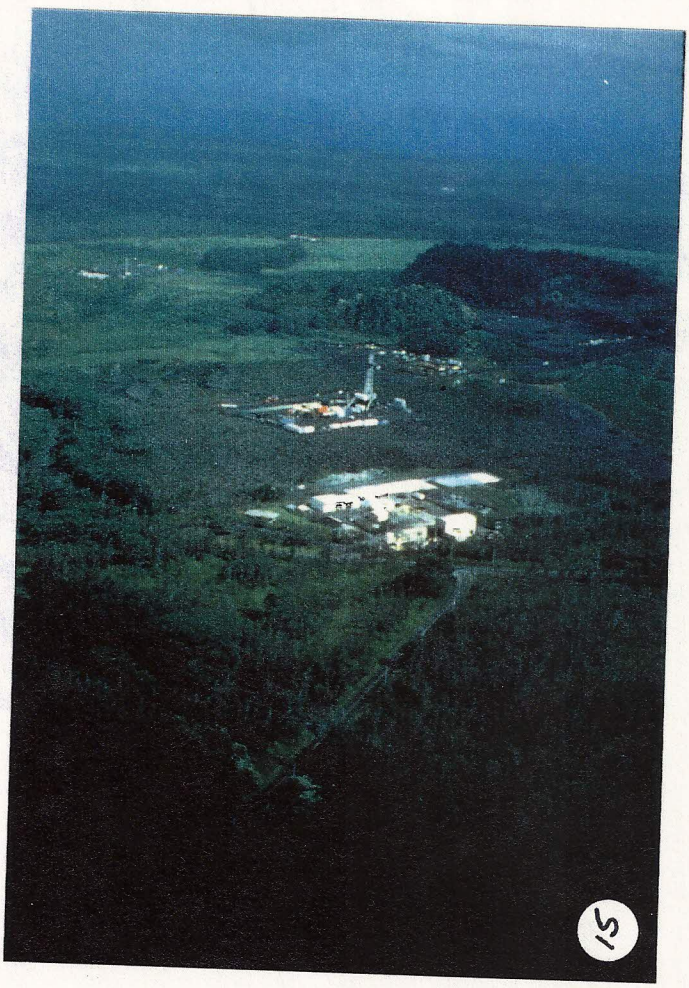
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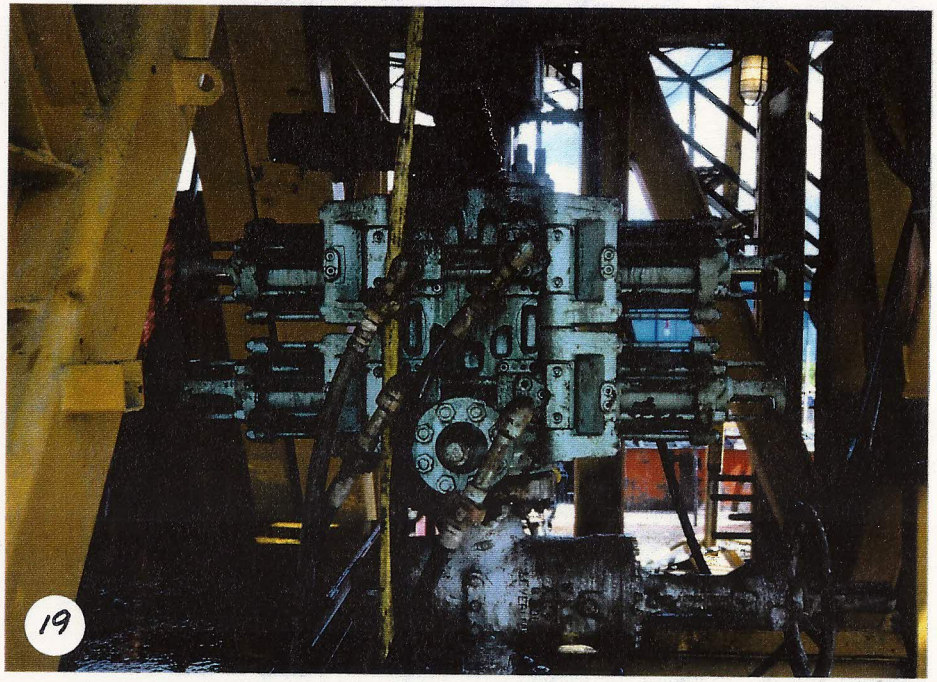
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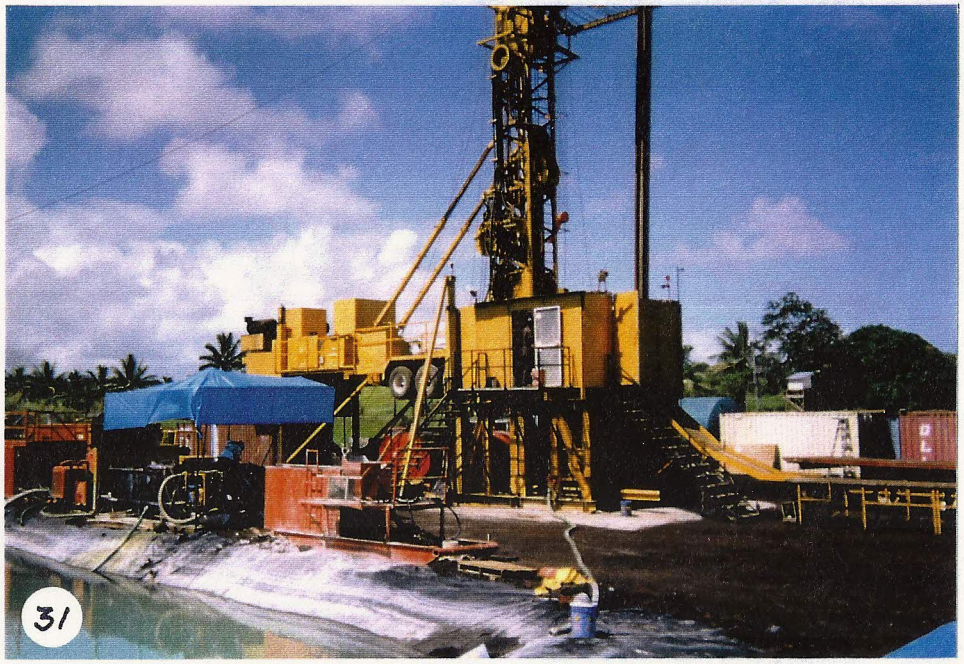
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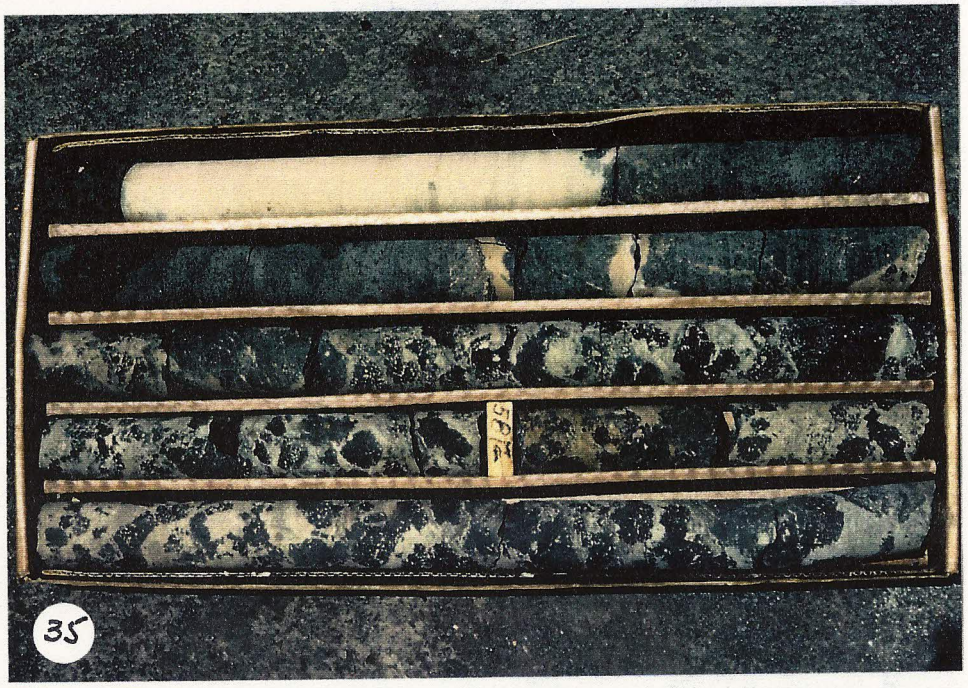
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